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describes eight new species of flowering plants from S. W. United States; C. H. Peck notices a new genus (Neopeckia) established by Saccardo, while Dr. Vasey describes two new Western grasses. ——Lists of the plant catalogues of Indiana, Illinois, Michigan and Wisconsin are given in the same number by W. R. Gerard and N. L. Britten.——Henry and James Groves continue their notes on British Characeæ in the January *Journal of Botany*, recording and figuring *Chara braunii*, found in Britain for the first time last September.——J. G. Baker, in the same number, continues his synopsis of the genus Selaginella, bringing the number of species up to one hundred and nine.——Dr. Farlow's Notes on the cryptogamic flora of the White mountains in *Appalachia* (Jan., 1884) is an interesting contribution to our knowledge of the lower plants of this region. Six new species of fungi are described, viz., *Doassansia epilobii*, *Propolis circularis*, *Stictis tsugæ*, *Cercospora pyri*, *Ramularia oxalidis*.

ENTOMOLOGY.

EGG-LAYING HABITS OF THE EGG-PARASITE OF THE CANKER WORM.—In our "Guide to the Study of Insects," (p. 200) we have briefly referred to a minute species of Platygaster which lays its eggs in those of the canker worm. We noticed on a pleasant day (Nov. 28, 1863, or a year or two earlier) two of these Platygasters upon two bunches of freshly laid eggs of the canker-worm moth, probably *Anisopteryx pometaria* Mann. We placed the eggs and ichneumons in a box, and returning to our room at the Museum of Comparative Zoölogy, watched the movements of the minute Platygasters with a lens of twenty-five diameters. One of them thrust its hind body down between the eggs, and while the rest of the body was still, and supported by the fore and hind legs, the wings resting on the top of the egg it was piercing, the antennæ were constantly vibrating. There could be seen a slight motion of the abdomen, the ovipositor meanwhile pushing and boring into the side of the egg. The operation of oviposition required from one to three, generally three, minutes. When the egg had been deposited in the right place, the Platygaster ran swiftly about, vibrating its antennæ more rapidly than before, until finding a suitable egg it suddenly paused, dropped its abdomen down between the eggs, and went through the same manœuvres as we have described. Sometimes it would suddenly take to its wings and fly off.

The other Platygaster kept on the under side of the loose bunch of eggs, where it found no good opportunity to oviposit. It was very uneasy, and would constantly run about from egg to egg. It would try for three or four minutes in vain to pierce the egg-shell, and we could see it thrust out its rather long, slender and sharp ovipositor, and apparently try to drill through the obdurate shell without success. It never attempted to pierce the top or bottom of the egg, but directed its efforts to the thinner sides. It would frequently stop and clean its head with its fore legs, and the end of the abdomen with its hind legs, as a fly does. —*A. S. Packard, Jr.*

PAIRED SEXUAL OUTLETS IN INSECTS.—J. A. Palmén records in the *Morphologische Jahrbuch*, 1883, the discovery in the May flies (Ephemeridæ) that the outlets of the sexual glands are paired, not only in the larvæ of all stages, but also in the imagines, and in both sexes, as had been earlier stated by Réaumer, Eaton and Joly. In the males the *vasa deferentia* pass through on the ventral side of the ninth segment two external appendages, both reproductive organs, at whose tips or sides the openings are situated. In the larvæ the female openings are not formed until after the last molt. In the females the two oviducts open on the ventral side of the hind body between the seventh and eighth segments.

Palmén suggests that the Ephemerids represent, in respect to the reproductive system among insects, a very primitive type of organization, and he concludes that the inner sexual organs of insects are built up of two different morphological elements, *i. e.*, (*a*) internal primitive paired structures (testes with *vasa deferentia*, ovaria with oviducts), and (*b*) integumental structures, such as the *ductus ejaculatorius* and vagina.

THE LARCH WORM.—For three summers past the existence of the larch, hackmatack or tamarack, in the northern portions of New England, New York, and portions of New Brunswick and Canada, has been threatened by a saw-fly larva. This proves to be the *Nematus erichsonii*, as the transformations, habits and imago appear to be the same. From Ratzeburg's description, the habits of the American worm are evidently like those of the European species, and it is very probable that the insect is common to both Europe and Northeastern America. At any rate our species could not have been introduced with European larches, since its ravages have been committed in the wilder, less frequented portions of Maine, New Hampshire and New York, as well as on the seaboard in towns long settled. In brief, the habits of our species are as follows: The eggs are laid in the terminal young shoots of the larch from about the middle of June, in Massachusetts, to the early part of July in Northern Maine, the larvæ feeding on the leaves late in June and in July and early August. By the last of July to the first week in August, according to the latitude, the worms are nearly fully grown, while a few half-grown ones occur on the trees in Maine in the last week of August and the early days of September. It is very doubtful whether there are two broods. We will now give a more detailed account of its habits, from a report on the causes of the destruction of evergreen forests extracted from the forthcoming annual report of the Entomologist, Department of Agriculture, 1883.

The eggs had all hatched by June 23–28; few were to be found at Brunswick, although the incisions made by the female were commonly observed. The female saw-fly makes about a dozen incisions in the terminal young, fresh, green shoot, sometimes in one of the side shoots next to the terminal one; judging by the shape of the hole the eggs are of the shape described by Ratzeburg, *i. e.*. oval cylindrical and about 1.5^{mm} in length. The eggs are placed in two rows, alternating, not exactly parallel, one being placed a little in advance of the other. The eggs are inserted at the base of the fresh, soft, young, partly-developed leaves of the new shoot, which is usually by June 20–30 only about an inch or an inch and a half in length. The presence of the eggs causes a deformation of the shoot, which curls over, the incisions being in all cases observed on one (the inner) side of the shoot. In many cases a last year's shoot was observed with the scars of the incisions on the concavity of the shoot. That the incisions were made by the saw-fly was proved by finding a freshly-hatched, but dead, larva in one of the holes. Sometimes one or two of the leaves die in consequence of the wounds made at their base.

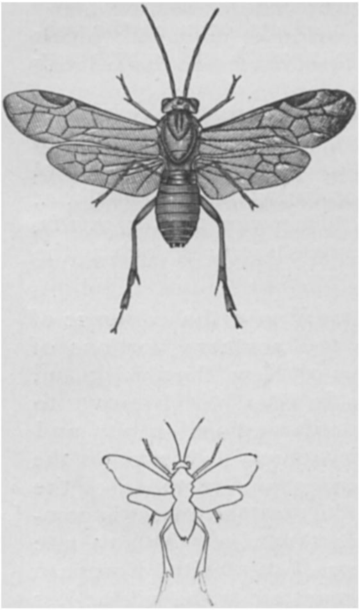

Fig. 1.

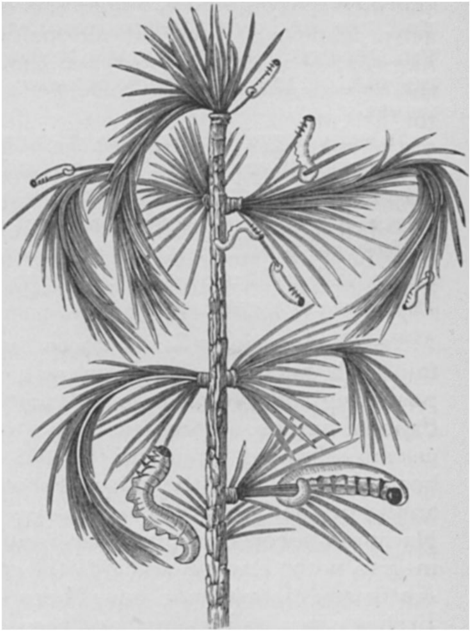

Fig. 2.

FIG. 1.—The larch saw-fly, nat. size and enlarged. Fig. 2.—The larch worm of different ages, nat. size. Miss L. Sullivan, del.

After the foregoing lines were written we fortunately observed a female in confinement, June 29, while engaged in the process of ovipositing; we should judge that the operation of sawing the slit and depositing the egg required not less than five minutes, and perhaps not much more than that length of time. The fly had been evidently at work for some time previous, as a number of eggs had been laid along the shoot; she had begun at the farther end and worked down to the base of the new, fresh, green shoot. She stood head downward while engaged in making the puncture, and was not disturbed by our removing the larch twig from the glass jar and holding it in our hand while watching the movements of the ovipositor under a Tolles triplet. The two sets of serrated blades of the ovipositor were thrust obliquely into the shoot by a sawing movement; the lower set of blades was most active, sliding in and out alternately, the general motion being like that of a hand-saw. After the incision is sufficiently deep, the egg evidently passes through the inner blades of the ovipositor, forced out of the oviduct by an evident expulsive movement of the muscles at the base of the ovipositor. The slit or opening of the incision after the egg has passed into it is quite narrow and about $1\frac{2}{5}^{\mathrm{mm}}$ in length. While engaged in the process the antennæ are motionless, but immediately after the ovipositor is withdrawn they begin to vibrate actively, the insect being then in search of a site for a fresh incision.

After making the foregoing observations we found at Phillips, Me., July 1, and at Errol, N. H., July 4, numerous twigs containing eggs, and the flies were also observed upon the trees ovipositing. Although the slit is at first closed, as soon as the embryo increases in size the twigs swell where they have been incised by the ovipositor, and the slits enlarge or gape more or less, becoming much larger and more conspicuous than when the eggs are first deposited. It would thus appear that oviposition takes place about a week later in the vicinity of Brunswick, Me., than in Essex county, Massachusetts, and about a week later in Northern Maine and New Hampshire than on the coast at Brunswick.

When the larva hatches the incision gapes open, leaving an oval hole. Out of this gape the larva creeps, and it rarely eats the terminal shoot, but crawls upon the leaves of the whorls next to the terminal shoot. At first it nibbles one side of the needle or leaf, leaving it half eaten and rough, serrate, and partly withered along the edge. The half-eaten, withered leaves of unequal length in a whorl on the ends of the smaller branches enable one to detect the presence of the young worms on the tree.

Usually after the young larvæ have shed their first skin, they collect on the verticils of the larch and almost invariably begin to eat the needles, one after another, beginning at the distal end and eating the leaf obliquely until only a short stump is left; in this way one verticil after another is eaten, and when the worms are half-grown they occasionally collect around the main stem of the twig in singular clumps or clusters, the hinder part of the body curled over their backs, and, owing to their oblique posture in reference to one another, appearing like a ball of worms. This singular appearance was briefly noticed by Ratzeburg. The castings or excrement are long, cylindrical, more or less truncated at each end. Our saw-fly differs slightly, as has been described, from the German in the eggs being laid at the base of the leaves on the newly-grown shoots, rather than on or just under the epidermis of the last year's shoots, where we have repeatedly and in vain searched for them. The larvæ were observed to hatch out from June 20 to 30 at Brunswick, Me.

The worms appear to attain their full size in about five to seven days after hatching; certainly less than or not more than ten days. There appear to be but three molts or changes of skin, *i. e.*, four stages of the larva. In casting the skin the head splits open along the median line of the vertex, and the epicranium or sides of the head split apart on each side, leaving the clypeus and labrum in place; then the body is drawn out of the rent, the skin adhering to the needle or leaf.—*A. S. Packard, Jr.*

THE HEMLOCK GELECHIA.—During the spring of 1883, the hemlock trees, large and small, in the vicinity of Providence, R. I., were observed to be much disfigured by the attacks of a small Tineid worm, causing sere and dead patches of leaves on the smaller branches and twigs of both large and small trees.

The small pale-green caterpillars bite off from six to eight leaves, constructing a broad, flat, irregular case; the leaves on being separated from the twig turning red or yellowish, thus forming a conspicuous patch. This rude case is held together with silk, the worm living in a rude silken tube, and feeding upon the inside of the leaves. The length of this tube, within which the little caterpillar finally changes to a chrysalis, is from 8 to 10^{mm} in length.

The worms are found from the first of May through the month of June. One changed to a pupa in its tube about the 20–25th of May, and the moth (in confinement) appeared June 1. Other chrysalids were found in the tubes from June 20 to 30, the moths making their appearance early in July. The larva, pupa, and moth are described in the report for 1883 of the Entomologist, U. S. Department of Agriculture.

The moth (*Gelechia abietisella*, n. sp.) is beautifully marked, and probably examples occur throughout the summer. Without doubt the eggs are laid on the twigs or leaves in the summer, and the caterpillars become almost full-fed before the winter, hibernating in their cases, becoming active in the spring. The worms are preyed upon by an ichneumon, the oval cocoon with one pupa which had recently transformed, and another ready to imaginate, occurring in the cases June 9th.—*A. S. Packard, Jr.*

FOOD-PLANTS OF THE ARMY WORM.—In Bulletin No. 3, Entomological Division, Dept. Agriculture, some new facts are recorded in reference to *Leucania unipuncta*, and notably an account of its injury to cranberry bogs. We quote the following in reference to its food-plants:

"The normal food-plants of the army worm are found among the grasses and grains, not a single species of either, so far as known, coming amiss. Wheat and oats seem to be its favorite among the small grains, though rye and barley are also taken with less relish. German millet, corn and sorghum, particularly when young and tender, are eaten by the worms. They were found, in 1881, feeding to a greater or less extent on flax in Illinois, although this is mentioned by Fitch as one of the crops which the worms will not touch. They have also been reported to eat onions, peas, beans and other vegetables, though probably only when pressed with hunger. As stated in our Eighth Missouri Report, upon the reliable authority of Mr. B. F. Mills, of Makanda, Ill., they have also been known to eat the leaves of fruit trees. Ordinarily clover is disregarded by the worms, though they occasionally nibble at it. A timothy field is often eaten to the ground, leaving the clover scattered through it standing. In this connection it may be well to state that on the Department grounds at Washington the newly-hatched worms have been found in a folded clover leaf, feeding thus protected, and under such circumstances as rendered it probable that they had been hatched there.

"Mr. Lockwood stated in his report (see last Annual Report of this Department) that even the common ragweed (*Ambrosia artemisiæfolia*) was eaten clean by the worms, and also that the worms in passing through a strawberry patch devoured both the leaves of the plant and the unripe fruit.

In order to establish upon proper authority the facts concerning what the army worm will and will not eat when pushed by hunger, we conducted during the summer of 1881–'82, a series of experiments upon different plants, placing each plant in a separate breeding-cage with a few healthy half-grown larvæ. The results show an unexpected power of accommodation to plants in many families, and no resultant variation in the imagines worth mentioning.

The results are summarized below:

PAPAVERACEÆ.—*Papaver somniferum.* (Garden poppy.)

Of four larvæ all attained full growth and entered the ground. Three moths issued.

CRUCIFERÆ.—*Brassica oleracea.* (Cabbage.)

The four larvæ in this case moved restlessly about for the first day without feeding. The second day they began to feed, and by the fifteenth all had changed to pupa. In this state two died, but the other two issued as moths.

CRUCIFERÆ.—*Raphanus sativus.* (Radish.)

Of four larvæ two lived to issue as moths; one died in the pupa, and one in the larva state.

MALVACEÆ.—*Gossypium herbaceum.* (Cotton.)

All died after feeding slightly.

VITACEÆ.—*Vitis labrusca.* (Grape.)

All died without feeding.

LEGUMINOSÆ.—*Pisum sativum.* (Garden pea.)

Of five larvæ all fed abundantly; transformed and issued as moths.

LEGUMINOSÆ.—*Phaseolus vulgaris.* (Garden bean.)

All died without touching the leaves.

ROSACEÆ.—*Fragaria virginiensis.* (Strawberry.)

The four larvæ experimented on all fed for from seven to ten days and then died without transforming.

ROSACEÆ.—*Rubus strigosus.* (Raspberry.)

Of eight larvæ all fed well and all transformed to pupa; only four, however, issuing as moths.

UMBELLIFERÆ.—*Daucus carota.* (Carrots.)

The four larvæ begun feeding on the second day; all transformed; two died in the pupa state and the other two issued as moths.

UMBELLIFERÆ.—*Pastinaca sativa.* (Parsnip.)

Of four larvæ one died before transforming, one in the pupa state, and the other two issued as moths.

COMPOSITÆ.—*Lactuca sativa.* (Garden lettuce.)

Of four larvæ one was destroyed by the others before they commenced to eat; the others all fed to full growth, transformed and issued as moths.

CHENOPODIACEÆ.—*Beta vulgaris.* (Garden beet.)

Of four larvæ, after feeding slightly, three died after six days; the remaining one fed more extensively, transformed to pupa and issued as an apparently healthy moth.

LILIACEÆ.—*Allium sativum.* (Onion.)

All fed; two died as larvæ, and the other two completed the round and issued as moths.

CONIFERÆ.—*Abies canadensis.* (Hemlock.)

All died without feeding.

SALIVARY AND OLFACTORY ORGANS OF BEES.—P. Shiemenz in this elaborate paper commences with the ordinary bibliographical résumé; he describes in detail the structure of the parts of the digestive tract which bears on the question of the salivary glands, and discusses their developmental history and their function. He points out that all glands have to supply a secretion, and that the more the separate cells take a larger share in this, the richer the secretion from a smaller number of secreting cells. In bees there are two essentially different modes by which this is effected and the two types may be appropriately spoken of as the *intracellular*, and the *intercellular*. In the simplest case of the latter we find a sac lined by a simple layer of cells, so arranged that each cell presents a proportionately broad surface to the common cavity; the material is obtained from the blood at the opposite ends of the cells. If the sac elongates, its diameter diminishes and we get the tubular form. In these two "systems" the cells are widest in a direction parallel to the lumen of the sac or tube. If the cells become spheroidal, there is a proportionate diminution in the secreting surface, and efferent canals appear between the cells. As a matter of fact, glands of this kind of construction do, among the Apidæ, stand remarkably close to the sacular or the tubular.

The intracellular type obtains in what the author calls his first, fourth and fifth system; here the cells are attached to long stalks and float in the collum, and thus it happens that the whole of their surface is able to take up the necessary matter from the blood. In connection with consequent large secretion, secretory canaliculi are developed, which make their way into the cells, surround the plasma, and so afford a correspondingly large surface for excretion. To this type a much greater secretory activity must be ascribed than to that in which secretion is intercellular. In the so-called fourth system we find that the intercellular spaces are very rare, and in the first (Bombus) the free cells are arranged in acini. Both these arrangements must be due to the large number of cells present.

The author concludes that the so-called crop has, in honey bees, the function of, at times, completely shutting off the honey-stomach from the chyle-intestine, while the small intestine forms the means of communication between the latter and the rectum. The salivary glands vary considerably both in genera and species, and it seems proable that their functions are also very varied. While one system of glands is formed within the *propria* of the first portion of the larval spinning glands, two others are derived from its efferent canals, and the other two are fresh structures formed by an invagination of the epidermis. The olfactory mucous gland of Wolff is salivary in function.

ENTOMOLOGICAL NOTES.—J. Nusbaum discusses in the *Zoologischer Anzeiger*, Jan. 7, the structure, development and morphology of Leydig's chorda, or so-called ventral vessel of Lepidoptera, which has lately been treated of by Burger and by Cattie. Nusbaum concludes that the chorda is a mesoskeleton; that it is analogous to, but not homologous with, the chorda of vertebrates, and that we may distinguish in the arthropoda, as in the vertebrates, two morphologically different parts in the internal skeleton: 1, an endoskeleton (endodermal chorda and its products); 2, a mesoskeleton (*i. e.*, Leydig's chorda).——Fritz-Müller describes in the same journal (p. 415, 16) the appendages of the abdomen in *Acræa thalia.*——Mr. A. E. Butler discusses the moths of the "Family Urapterygidæ" in the collection of the British Museum. Why the category of a family should be applied to what appears to us to be scarcely a sub-division of a sub-family of geometrids shows to what extremities systematists of an exceedingly analytical turn of mind will sometimes go. Why should not the inspection of such immense collections as those of the British Museum lead to broader taxonomical views?——The late Hermann Müller treats in *Kosmos* of the intelligence of the honey bee, and its difference in different races.——" Ants and their Ways" is the title of a little book by W. F. White, published by the London Religious Tract Society.——The prolonged existence of Ichneumon in the pupa state is noticed by W. McRae in the *Entomologist*, p. 188.——Several interesting papers on the Collembola, by G. Brook, have appeared during the past year in the Journal of the Linnæan Society of London; among others a revision of the genus Entomobrya, of which Degeeria of Nicolet is a synonym. Packard's *Degeeria 10-fasciata*, a common U. S. species, is referred to the common European *Entomobrya multifasciata*, of which Say's *Podura fasciata* is also regarded by Mr. Brook as a synonym.

ZOÖLOGY

NOTES ON MEDUSÆ — *(Continued from February number).*—*Stomatonema reticulatum*, n. g. and s.—I have given the name of *Stomatonema reticulatum* to a new Discophore from the South Atlantic, which has affinities with Cassiopea, Aurelia, and others, and seems to me to throw considerable light on the homologies of certain peculiar bodies called "crests," found on the oral cylinder of that curious genus from the Florida Keys, known as Stomolophus.

The body is an inch and a half in diameter, is rounded, bell-shaped above, with thick gelatinous walls. The margin of the bell is much thinner than the central region, and on its floor is a fine reticulation of anastomosing tubes. The region of this network of tubes forms a narrow zone, whose outer edge is the bell margin. There are no marginal tentacles as in Cassiopea and some other related genera of Discophora.

The marginal sense-bodies are more closely allied to those of Aurelia than to the same structures in Cyanea or Rhizostoma. The sense-bodies are eight in number, placed at regular intervals about the rim of the bell. Each sense-body is covered with a hood, and on either side, continued for a short distance beyond the sense-bulbs, is a lappet similar to like structures in the genus Aurelia. In addition to the zone of anastomosing tubes mentioned as being found on the bell margin, there are other vessels which arise from the central stomach cavity, and pass directly without bifurcation to the inner rim of the marginal network. Between these last there are still others, also straight and unbranched, which arise from the inner rim of the marginal net of tubes and extend centripetally, ending blindly in the bell substance on the lower floor.

The oral appendages of Stomatonema are characteristic. They hang from the lower floor by four attachments, in the intervals between which are placed the large globular ovarian sacs. The oral appendages are small, eight in number, and have a remote likeness to those of Aurelia. On the under side of each a groove is formed between two wing-like folds, which hang down and